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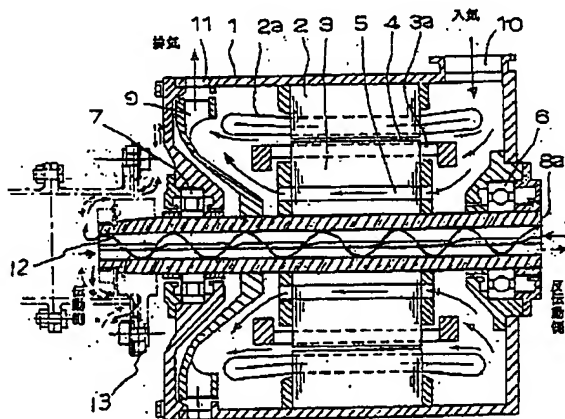
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(54) 【発明の名称】 電気車両用主電動機

(57) 【要約】

【課題】電気車両用主電動機の軸受の温度上昇を抑制し、軸受の焼損を防止することにより電気車両の運転事故を防止する。

【解決手段】軸の一方の端部に伝動用の該軸端部が外気に開口している継手13が連結される電気車両用主電動機の回転子軸8aに、中空孔を設け、該中空孔に全域又は一部にわたりねじファン12を嵌合固着する。かつ、該ねじファン嵌合固着の両軸端面は開口する。



## 【特許請求の範囲】

【請求項1】 軸の一方の端部に該軸端部が外気に開口している伝動用の継手(13)が連結される電気車両用主電動機の回転子軸(8a)に同一内径の中空孔を設け、該中空孔に全域にわたりねじファン(12)を嵌合固着する。かつ、該ねじファン嵌合固着の両軸端面は開口する。以上のように構成されてなる電気車両用主電動機。

【請求項2】 請求項1記載のねじファンの長さを短くし、中空軸(8b)の伝動側の中空孔径をねじファン(12a)の外径より小さく穿設し、且つ大小の中空孔を直角又はテーパ状に連結し、中空軸(8b)の反伝動側より内径部に嵌合固着した請求項1記載の電気車両用主電動機。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、誘導電動機、直流電動機等の電気車両用主電動機の軸受及び回転子鉄心冷却に関するものである。

## 【0002】

【従来の技術】従来の電気車両用主電動機は通電時の発熱によって加熱されると、絶縁体の劣化が促進され寿命が低下すると共に、発熱体の強度の低下及び軸受の焼損を招くため、機内を冷却する必要がある。冷却の手段の一つとして、回転子の回転を利用し内蔵ファンを回して冷却風を機内に流通する自己通風形と別ファンによる他力通風形とがある。

【0003】図4は従来の自己通風形の電気車両用主電動機の一機種である誘導電動機の縦断面図で、1はフレーム、2は固定子鉄心、2aは固定子コイル、3は回転子鉄心、3aは回転子コイル、4はエアギャップ部、5は回転子の風穴、6、7は軸受、8は回転子軸、9はファン、10は入気口、11は排気口、13は継手である。

【0004】この主電動機に通電し稼働させると、回転子軸8と一体的にファン9が回転することによってフレーム1の一端に設けられた入気口10から冷却風が機内に流入し、冷却風は固定子鉄心2と回転子鉄心3との間のエアギャップ部4および回転子の風穴5を矢印の如く通って他端側の排気口11から排出され、これによって機内の発熱体を冷却していた。

【0005】他力通風形の場合はファン9が機内に設置されておらず、別ファンにより入気口10より強制的に冷却風が送り込まれ、エアギャップ4および風穴5を通り排気口11より排出され、機内の発熱体を冷却していた。

## 【0006】

【発明が解決しようとする課題】従来の電気車両用主電動機は前述の如く構成されているので、主電動機に組込まれている軸受6、7は自体の回転損失による発熱と、回転子鉄心3の発熱の回転子軸8を伝えてくる伝導熱により加熱される。

【0007】しかしながら、入気側の軸受6の軸受箱の

一部は冷却風により冷却されるが、ファン側の軸受7はファン9によって遮られ、冷却風が軸受7の軸受箱を冷却することができない。又冷却風で直接回転子軸8を冷却しにくい構造になっていた。更に回転子軸8の反伝動側軸端は外部に露出していないため軸受6の内輪は外気で直接冷却ができない等軸受6、7を効果的に冷却出来ず、温度上昇が高くなりスベックオーバーする恐れがあった。

【0008】本発明は、上述の点に鑑み創案されたもので軸受および回転子鉄心の温度上昇を効果的に抑制しスベック内に収まるようにする冷却装置を提供することを目的としている。

## 【0009】

【課題を解決するための手段】上記目的を達成するために、主電動機の回転子軸を中空とし、該中空軸内径部の一部又は全部にねじファンを嵌合固着し両軸端面を開口する。また、伝動側軸端部に装着される継手13の内中央部が外気に通ずるような継手、例えばタワミ板を使用した継手又は十字継手等を使用する。

## 【0010】

【作用】上記のように構成されたねじファンにより、主電動機がある回転方向の時は反伝動側軸端より外気を吸込み伝動側に排出し、他の回転方向の時は上記の反対になる。ねじファンは回転子軸のフィンの役目をするものである。

## 【0011】

【実施例】本実施例は電気車両用主電動機についてのものである。実施例について図1、2を参照して、以下に説明する。図1において、8aは同一内径の中空の回転子軸で内径部にねじファン12が嵌合固着され、両軸端面は外気に開口されている。また、伝動側軸端部に装着される継手13の内中央部が外気に通ずるような継手、例えばタワミ板を使用した継手又は十字継手等を使用する。

【0012】本実施例では中空軸の内径部全域にねじファンが構成されているが、図2に示すように中空軸の伝動側の中空孔径をねじファン(12a)の外径より小さく穿設し、且つ大小の中空孔を直角又はテーパ状に連結し、反伝動側にねじファン12aを設けてもよい。また、実施例図では一重ねじファンを示しているが二重、三重等に構成してもよい。

【0013】上述の構成において、図1、図2に示してあるものは反伝動側軸端より見て時計方向に回転軸が回転した時、外気は反伝動側軸端より吸込まれて伝動側に排出され、逆回転の場合はその反対となる。

【0014】上記は電気車両用主電動機として自己通風形誘導電動機のものについて述べたが、他力通風形および自己通風形、他力通風形の直流電動機12についても同様である。

【0015】また、上記の主電動機は自己通風形、他力通風形に応用したものであるが全閉形の電動機について

も応用できる。

【0016】

【発明の効果】本発明によれば、回転子の中空軸内に設置したねじファンによって回転子軸を冷却し、軸受および回転子鉄心の温度上昇を抑制でき、スベックオーバーする恐れがなくなる。

【図面の簡単な説明】

【図1】本発明に係る冷却装置付の電気車両用主誘導電動機の縦断面図である。

【図2】本願発明に係る電気車両用主電動機の回転子軸の他の実施例図である。

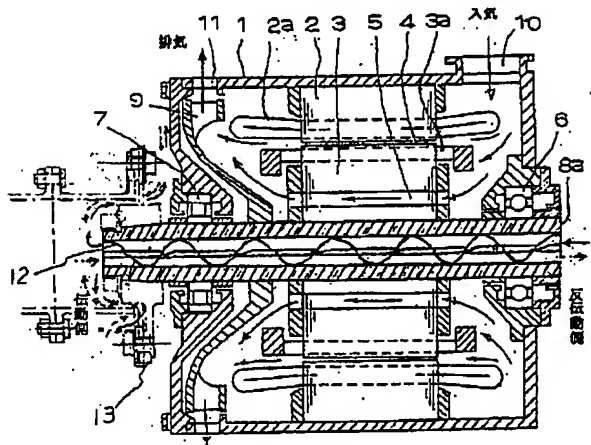
【図3】従来の電気車両用主誘導電動機の縦断面図である。

【符号の説明】

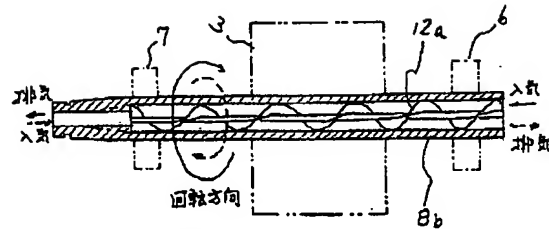
- 1 フレーム  
2 固定子鉄心

- 2a 固定子コイル  
3 固定子鉄心  
3a 固定子コイル  
4 エアギャップ  
5 風穴  
6 軸受  
7 軸受  
8 回転子軸（ソリッド）  
8a 回転子軸（中空）  
8b 回転子軸（中空）  
9 ファン  
10 入気口  
11 排気口  
12 ねじファン  
12a ねじファン  
13 継手

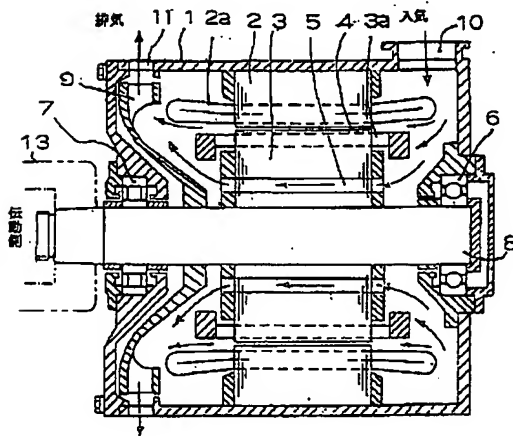
【図1】



【図2】



【図3】



# PATENT ABSTRACTS OF JAPAN

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(21)Application number : 07-208321

(71)Applicant : TOYO ELECTRIC MFG CO LTD

(22)Date of filing : 24.07.1995

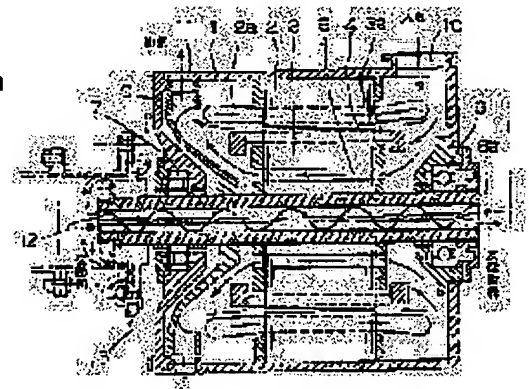
(72)Inventor : OIKAWA AKIO

## (54) MAIN MOTOR FOR ELECTRIC VEHICLE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To prevent the driving faults of electric vehicles, by suppressing the temperature rise of the bearings of the motors for electric vehicles to prevent the burning of the bearings.

**SOLUTION:** In rotor shafts 8a of the main motors for electric vehicles to whose one end portions transmission joints 13 with its axial end portions opened to the outside air are coupled, hollow holes are so bored as to fix in the engagement way extensively screw fans 12 in its whole or partial regions and open both its axial end surfaces after the fixing the fans 12 to the outside air.



## LEGAL STATUS

[Date of request for examination]

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[Patent number]

[Date of registration]

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**CLAIMS**

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[Claim(s)]

[Claim 1] A hollow hole of the same bore is prepared in a rotor axis (8a) of a main motor for electric rolling stock with which a joint for transmission (13) this axis end section is carrying out [ a joint ] the opening to the open air is connected with one edge of a shaft, and fitting fixing of the rear-spring-supporter screw-thread fan (12) is carried out in the whole region at this hollow hole. And the opening of both the axis end side of this screw-thread fan fitting fixing is carried out. A main motor for electric rolling stock which it comes to constitute as mentioned above.

[Claim 2] A main motor for electric rolling stock according to claim 1 which shortened the length of screw-thread FA according to claim 1, \*\*\*\*ed a hollow aperture by the side of transmission of a hollow shaft (8b), and punctured smaller than a fan's (12a) outer diameter, and connected a large and small hollow hole a right angle or in the shape of a taper, and carried out fitting fixing from an anti-transmission side of a hollow shaft (8b) at the bore section.

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**DETAILED DESCRIPTION**


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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the bearing of main motors for electric rolling stock, such as an induction motor and a direct current motor, and rotor core cooling.

[0002]

[Description of the Prior Art] The conventional main motor for electric rolling stock needs to cool the inside of a plane in order to cause lowering of the reinforcement of a heating element, and burning of bearing while deterioration of an insulating material will be promoted and a life will fall, if heated by pyrexia at the time of energization. There are a self-ventilation type which uses the revolution of a rotator, transfers a built-in fan as one of the means of cooling, and circulates a cooling wind to the inside of a plane, and a separate circulation of coolant type by another fan.

[0003] drawing of longitudinal section of an induction motor whose drawing 4 is 1 model of the main motor for electric rolling stock of the conventional self-ventilation type -- it is -- 1 -- a frame and 2 -- a stator core and 2a -- a stator coil and 3 -- a rotor core and 3a -- a rotator coil and 4 -- the air gap section and 5 -- for a rotor axis and 9, as for intake air opening and 11, a fan and 10 are [ the louver of a rotator, and 6 and 7 / bearing and 8 / an exhaust port and 13 ] joints.

[0004] If it energizes to this main motor and it is worked, a cooling wind will flow into the inside of a plane from the intake air opening 10 prepared in the end of a frame 1 when a fan 9 rotated in one with a rotor axis 8. Like the arrow head, the cooling wind was discharged from the exhaust port 11 by the side of the other end through the air gap section 4 between a stator core 2 and a rotor core 3, and the louver 5 of a rotator, and had cooled the heating element inside the plane by this.

[0005] In the case of the separate circulation of coolant type, a fan 9 was not installed in the inside of a plane, but the cooling wind was sent in more compulsorily than the intake air opening 10 by another fan, and it was discharged from the exhaust port 11 through the air gap 4 and the louver 5, and it had cooled the heating element inside the plane.

[0006]

[Problem(s) to be Solved by the Invention] Since the conventional main motor for electric rolling stock is constituted like the above-mentioned, the bearing 6 and 7 included in the main motor is heated by the conductive heat which transmits the rotor axis 8 of pyrexia by revolution loss of the very thing, and pyrexia of a rotor core 3.

[0007] However, although a part of bearing housing of the bearing 6 by the side of intake air is cooled more in the style of cooling, the bearing 7 by the side of a fan is interrupted by the fan 9, and a cooling wind cannot cool bearing housing of bearing 7. Moreover, it had become the structure which is the style of cooling and cannot cool the direct rotor axis 8 easily. Furthermore, since the anti-transmission side shaft edge of a rotor axis 8 was not exposed outside, the inner ring of spiral wound gasket of bearing 6 could not cool effectively the homaxial carriers 6 and 7 which cannot perform direct cooling by the open air, but the temperature rise became high and it had a possibility of carrying out spec. over.

[0008] This invention aims at offering the cooling system was originated in view of the above-mentioned point, and controls the temperature rise of bearing and a rotor core effectively, and it is made to be settled in spec.

[0009]

[Means for Solving the Problem] In order to attain the above-mentioned object, a rotor axis of a main motor is made hollow, it \*\*\*\*s to a part or all of this hollow shaft bore section, fitting fixing of the fan is carried out, and the opening of both the axis end side is carried out. Moreover, a joint with which an inner center section of the joint 13 with which a transmission side shaft edge is equipped is well-informed about the open air, for example, a joint which used a deflection board, a cross joint, etc. are used.

[0010]

[Function] It \*\*\*\*s, by the fan, when it is the hand of cut with a main motor constituted as mentioned above, the open

air is inhaled from an anti-transmission side shaft edge, and it discharges to a transmission side, and it becomes reversely [ above-mentioned ] at the time of other hands of cut. A screw-thread fan does the duty of the fin of a rotor axis.

[0011]

[Example] This example is a thing about the main motor for electric rolling stock. An example is explained below with reference to drawing 1 and 2. In drawing 1, 8a is \*\*\*\*ed in the bore section with the rotor axis of the hollow of the same bore, fitting fixing of the fan 12 is carried out, and the opening of both the axis end side is carried out to the open air. Moreover, a joint with which the inner center section of the joint 13 with which a transmission side shaft edge is equipped is well-informed about the open air, for example, the joint which used the deflection board, a cross joint, etc. are used.

[0012] Although it \*\*\*\*s throughout the bore section of a hollow shaft and the fan consists of this examples, as shown in drawing 2, the hollow aperture by the side of transmission of a hollow shaft is \*\*\*\*ed, and it punctures smaller than a fan's (12a) outer diameter, and a large and small hollow hole is connected a right angle or in the shape of a taper, it \*\*\*\*s to an anti-transmission side, and fan 12a may be prepared. Moreover, although the single screw-thread fan is shown, you may constitute from example drawing in a duplex, Mie, etc.

[0013] In an above-mentioned configuration, when what is shown in drawing 1 and drawing 2 is seen from an anti-transmission side shaft edge and the axis of rotation rotates clockwise, the open air is inhaled from an anti-transmission side shaft edge, and is discharged at a transmission side, and, in the case of counterrotation, it becomes the objection.

[0014] Although the above described the thing of a self-ventilation type induction motor as a main motor for electric rolling stock, it is the same also about the direct current motor 12 of a separate circulation of coolant type and a self-ventilation type, and a separate circulation of coolant type.

[0015] Moreover, the above-mentioned main motor is applicable also about the motor of a dust-protection type, although applied to a self-ventilation type and a separate circulation of coolant type.

[0016]

[Effect of the Invention] According to this invention, it \*\*\*\*s, and a rotor axis is cooled by the fan, the temperature rise of bearing and a rotor core can be controlled, and a possibility installed in the hollow shaft of a rotator of carrying out spec. over disappears.

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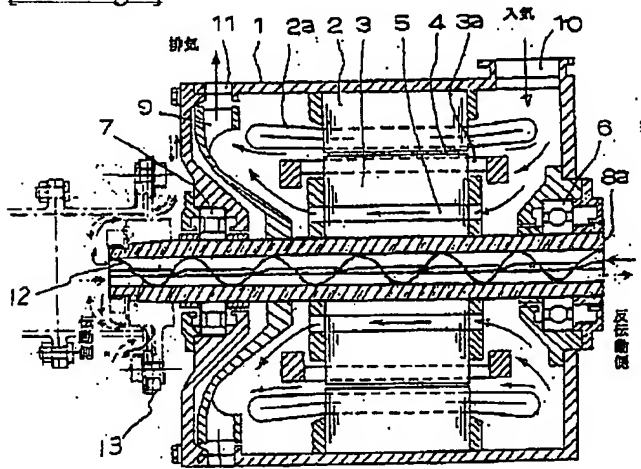
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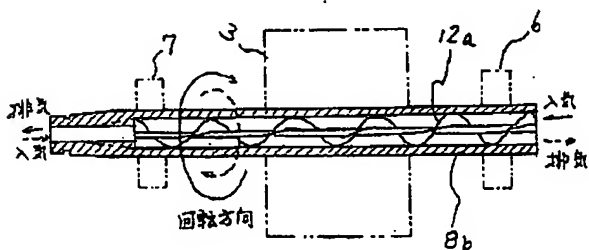
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## DRAWINGS

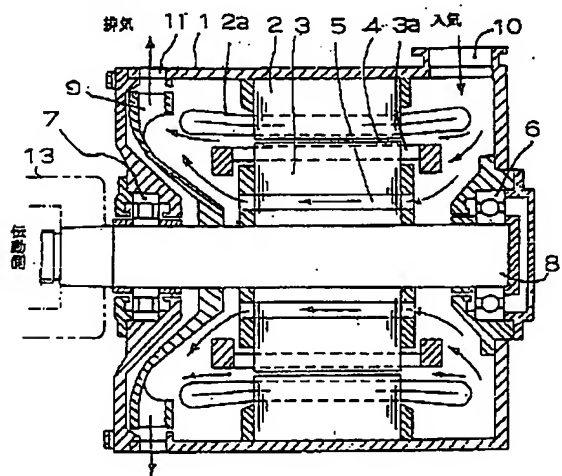
[Drawing 1]



[Drawing 2]



[Drawing 3]





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PN - JP9046960 A 19970214  
 PD - 1997-02-14  
 PR - JP19950208321 19950724  
 OPD - 1995-07-24  
 TI - MAIN MOTOR FOR ELECTRIC VEHICLE  
 IN - OIKAWA AKIO  
 PA - TOYO ELECTRIC MFG CO LTD  
 IC - H02K5/20 ; F16C37/00

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TI - Reversible main motor for electric vehicle - provides supplementary forced air cooling for rotor and bearings with spiral screw fan fixed inside axial air hole in hollow shaft  
 PR - JP19950208321 19950724  
 PN - JP9046960 A 19970214 DW199717 H02K5/20 003pp  
 PA - (TODE ) TOYO DENKI SEIZO KK  
 IC - F16C37/00 ;H02K5/20  
 AB - J09046960 The motor provides a supplementary forced air cooling for its rotor ( 3) and bearings ( 6,7) besides a conventional cooling provided by a shaft mounted fan ( 9) which also cools a stator ( 2). This supplementary cooling is provided by a spiral screw fan ( 12) fixed inside an axial air hole in a hollow shaft ( 8a). The spiral fan is joined to the shaft over a whole length and both ends of the shaft are opened for cooling air to enter and exit.  
 - An external coupling ( 13) is fixed to the shaft at one end for transmitting power which assists in forcing air into or out of the hollow shaft.  
 - ADVANTAGE - Inhibits temperature rise in rotor core and bearings. Prevents burning in bearings.  
 - (Dwg. 1/3) .  
 OPD - 1995-07-24  
 AN - 1997-186684 [17]

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PN - JP9046960 A 19970214  
 PD - 1997-02-14  
 AP - JP19950208321 19950724  
 IN - OIKAWA AKIO  
 PA - TOYO ELECTRIC MFG CO LTD  
 TI - MAIN MOTOR FOR ELECTRIC VEHICLE  
 AB - PROBLEM TO BE SOLVED: To prevent the driving faults of electric vehicles, by suppressing the temperature rise of the bearings of the motors for electric vehicles to prevent the burning of the bearings.  
 - SOLUTION: In rotor shafts 8a of the main motors for electric vehicles to whose one end portions transmission joints 13 with its axial end portions opened to the outside air are coupled, hollow holes are so bored as to fix in the engagement way extensively screw

fans 12 in its whole or partial regions and open both its axial end surfaces after the fixing the fans 12 to the outside air.

- H02K5/20 ; F16C37/00

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